

lastly, it renders possible the total regeneration of the nucleus. In the present state of our knowledge, however, there is obviously much that is hypothetical in the respective importance of these consequences.

It is chiefly in his researches on the embryology of Nematoda that Prof. Carnoy has reached conclusions which are totally at variance with those already arrived at on the same subject by Messrs. Nussbaum and E. Van Beneden. We allude especially to the mode of formation of the polar bodies in the egg of *Ascaris megalocephala*. For the Louvain Professor, the two successive divisions which take place in the germinal vesicle assume the following characters:—

(1) The nuclear element ("élément nucléinien typique") of the egg of *Ascaris megalocephala* becomes at an early stage broken up into eight nearly equal rod-like portions; these at once separate into two groups of four rods ("bâtonnets"), thus constituting the Wagnerian spots.

(2) When a spermatozoid has made its way into the egg, sometimes very soon afterwards, occasionally later, an alteration of the germinal vesicle becomes visible; its membrane dissolves away, and subsequently, by a process of true karyokinetic division accompanied by the formation of asters of remarkable variety and complexity, the first polar body is expelled. This he finds to consist of four nuclear rods and a portion of the protoplasm of the egg. At this stage, therefore, according to Dr. Carnoy, four rods only remain within the egg.

(3) Now the same process begins again, in all essential respects resembling that which has just been described; finally, the second polar body is expelled in its turn. It consists of two nuclear rods, so that only two rods remain now in the egg for the formation of the female pronucleus. We are thus in a position to calculate accurately the amount of nuclein lost by the germinal vesicle during the expulsion of the polar bodies. According to Prof. Carnoy, the loss, for *Ascaris megalocephala*, would amount exactly to three-fourths of the nuclein originally present in the egg.

We are not sure whether Prof. E. Van Beneden's views on this delicate question may not be to a certain extent reconciled with those of the eminent biologist of Louvain, especially as regards the number of nuclear portions contained in the first polar body. But respecting the constitution of the second polar body the views of the two Belgian observers are certainly difficult, if not impossible, to reconcile.

Prof. Carnoy's book reads easily, and his statements are always clear and definite. The text is illustrated by a large number of figures, beautifully executed, which greatly enhance the value of this most interesting and important work.

L. MARTIAL KLEIN.

OUR BOOK SHELF.

The Climatic Treatment of Consumption: a Contribution to Medical Climatology. By J. A. Lindsay, M.A., M.D. (London: Macmillan and Co., 1887.)

DR. LINDSAY does not profess to have written a systematic and exhaustive treatise upon the climatic treatment of consumption. He holds that we are only on the threshold of climatological investigation: and "for its

exhaustive discussion," he says, "prolonged inquiry will be necessary, and more exact methods than those hitherto generally employed." He has made, however, an important contribution to the study of a very difficult subject, and his book ought to be of much service not only to physicians but to many sufferers who may still hope to find in climatic treatment a powerful adjunct to hygienic and medical measures. Having discussed the causes of consumption and the general principles of climatic treatment, Dr. Lindsay presents a general view of the chief sanatoria for consumption. He then describes mountain sanatoria and the ocean voyage, and gives a full and trustworthy account of sanatoria he himself has visited, including Australia, Tasmania, New Zealand, California, the Cape, Algeria, Southern France, and the home sanatoria. The value of the book is, of course, greatly increased by the fact that he has relied for his information mainly on personal observation.

Illustrations of the British Flora. Drawn by W. H. Fitch, F.L.S., and W. G. Smith, F.L.S. Second Edition. (London: L. Reeve and Co., 1887.)

WHEN the illustrated edition of Bentham's "Hand-book of the British Flora" was exhausted, the wood engravings of that work were reproduced in a volume intended to serve as a companion to the "Hand-book" and other British Floras. The volume has been so popular that the publishers have found it necessary to issue a second edition; and they have taken pains to secure that it shall be more useful than ever to students of botany, and especially to beginners. Five cuts have been added, and the arrangement of all the illustrations has been brought into accordance with Bentham's "Hand-book" as it has been revised by Sir J. D. Hooker. To facilitate reference from other Floras, the index has been greatly enlarged, and there is a new index of English and popular names.

Sketches of Life in Japan. By Major Henry Knollys, R.A. With Illustrations. (London: Chapman and Hall, 1887.)

IN this book Major Knollys undertakes to tell us something of "the minor lights and shades" of the social life of Japan. He is a careful observer, and writes brightly and pleasantly; and no doubt the lively record of his impressions will interest a good many readers who would not have cared to study a more elaborate and systematic account of the Japanese people. The substance of the book was written "on the spot," but all statements with regard to matters of fact have been carefully revised.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

Thought without Words.

THERE appears to be some ambiguity about this matter as discussed in the correspondence which has recently taken place in your columns. In the first instance Mr. Galton understood Prof. Max Müller to have argued that in no individual human mind can any process of thought be ever conducted without the mental rehearsal of words, or the *verbum mentale* of the Schoolmen. Now, although this is the view which certainly appears to pervade the Professor's work on "The Science of Thought," there is one passage in that work, and several passages in his subsequent correspondence with Mr. Galton, which express quite

a different view—namely, that when a definite structure of conceptual ideation has been built up by the aid of words, it may afterwards persist independently of such aid; the scaffolding was required for the original construction of the edifice, but not for its subsequent stability. That these two views are widely different may be shown by taking any one of the illustrations from the NATURE correspondence. In answer to Mr. Galton, Prof. Max Müller says, "It is quite possible that you may *teach* deaf-and-dumb people dominoes; but deaf-and-dumb people, left to themselves, do not *invent* dominoes, and that makes a great difference. Even so simple a game as dominoes would be impossible without names and their underlying concepts." Now, assuredly it does "make a great difference" whether we are supporting the view that dominoes could not be *played* without names underlying concepts, or the view that without such means dominoes could not have been *invented*. That there cannot be concepts without names is a well-recognized doctrine of psychology, and that dominoes could not have been invented in the absence of certain simple concepts relating to number no one could well dispute. But when the game has been invented, there is no need to fall back upon names and concepts as a preliminary to each move, or for the player to predicate to himself before each move that the number he lays down corresponds with the number to which he joins it. The late Dr. Carpenter assured me that he had personally investigated the case of a performing dog which was exhibited many years ago as a domino-player, and had fully satisfied himself that the animal's skill in this respect was genuine—i.e. not dependent on any code of signals from the showman. This, therefore, is a better case than that of the deaf-mute, in order to show that dominoes can be played by means of sensuous association alone. But my point now is that two distinct questions have been raised in your columns, and that the ambiguity to which I have referred appears to have arisen from a failure to distinguish between them. Every living psychologist will doubtless agree with Prof. Max Müller where he appears to say nothing more than that if there had never been any names there could never have been any concepts; but this is a widely different thing from saying what he elsewhere appears to say, i.e. that without the mental rehearsal of words there cannot be performed in any case a process of distinctively human thought. The first of these two widely different questions may be dismissed, as one concerning which no difference of opinion is likely to arise. Touching the second, if the Professor does not mean what I have said he appears in some places to say, it is a pity that he should attempt to defend such a position as that chess, for instance, cannot be played unless the player "deals all the time with thought-words and word-thoughts." For the original learning of the game it was necessary that the powers of the various pieces should have been explained to him by means of words; but when this knowledge was thus gained, it was no longer needful that before making any particular move he should mentally state the powers of all the pieces concerned, or predicate to himself the various possibilities which the move might involve. All these things he does by his specially-formed associations alone, just as does a draught-player, who is concerned with a much simpler order of relations: in neither case is any demand made upon the *verbum mentale*.

Again, if the Professor does not mean to uphold the view that in no case can there be distinctively human thought without the immediate and direct assistance of words, it is a mistake in him to represent "the dependence of thought on language" as absolute. The full powers of conceptual ideation which belong to any individual man may or may not all have been due to words as used by his ancestors, his contemporaries, and himself. But, however this may be, that these powers, when once attained, may afterwards continue operative without the use of words is not a matter of mere opinion based on one's own personal introspection, which no opponent can verify: it is a matter of objectively demonstrable fact, which no opponent can gainsay. For when a man is suddenly afflicted with aphasia he does not forthwith become as the thoughtless brute: he has lost all trace of words, but his reason may remain unimpaired.

June 4.

GEORGE J. ROMANES.

¹ e.g. "I hope I have thus answered everything that has been or that can possibly be adduced against what I call the fundamental tenet that the science of language, and what ought to become the fundamental tenet of the science of thought, namely that language and thought, though distinguishable, are inseparable, that no one truly thinks who does not speak, and that no one truly speaks who does not think."—"Science of Thought," pp. 63-64.

I HAVE postponed offering you any remarks on Prof. Max Müller's "Science of Thought," until I had read the book through.

I think Prof. Müller is on the whole right, that language is necessary to thought, and is related to thought very much as organization to life. The question discussed by some of your correspondents, whether it is possible in particular cases to think without language, appears to me of little importance. I can believe that it is possible to think without words when the subjects of thought are visible things and their combinations, as in inventing machinery; but the intellectual power that invents machinery has been matured by the use of language.

But Prof. Müller has not answered, nor has he asked, the question, on what property or power of thought the production of language depends. He has shown most clearly the important truth that all names are abstract—that to invent a name which denotes an indefinite number of objects is a result of abstraction. But on what does the power of abstraction depend? I believe it depends on the power of directing thought at will. Prof. Müller lays stress on the distinction between percepts and concepts, though he thinks they are inseparable. I am inclined to differ from him, and to think that animals perceive as vividly as we do, but have only a rudimentary power of conception and thought. I think the power of directing thought at will is the distinctively human power, on which the power of forming concepts and language depends.

JOSEPH JOHN MURPHY.

Belfast, June 19.

AFTER reading the correspondence published in NATURE (vol. xxxvi. pp. 28, 52, and 100) on this subject, it has occurred to me that the difficulties anthropologists find in Prof. Max Müller's theory are connected chiefly with his peculiar definitions.

In his letters to Mr. Galton, Prof. Müller narrows the domain of his theory to a considerable extent. By defining thought as the faculty of "addition and subtraction," and by taking language as composed of "word-thoughts" or "thought-words," Prof. Müller excludes from his theory all those processes which are preliminary to the formation of concepts. Thus narrowed, I do not see that his doctrine in any way touches the wider question, whether reasoning, as generally understood, is independent of language. If we keep to the terms of this theory, thoughts and words are undoubtedly inseparable. But this does not in the least imply that all thought is impossible without words.

When we enlarge the scope of our terms, it is at once evident that thoughts and words are not inseparable. It is all very well to join together "thought-word" and "word-thought." Yet the thought is something quite distinct from the mere sound which stands as a word for it. A concept is formed from sensations. Our thoughts are occupied with what we see, and feel, and hear, and this primarily. Thus it is that, in the wider sense of thinking, we can think in pictures. This is the mental experience which Prof. Tyndall so highly prizes. He likes to picture an imaginary process, not in words, not even by keeping words in the background, but in a mental presentation of the things themselves as they would affect his senses. Surely, then, if the mind can attend to its own reproduction of former sensations, and even form new arrangements of sensations for itself quite irrespective of word-signs, as Mr. Galton and most other thinkers have experienced, it is evident that thought and language are not inseparable.

All this is, of course, somewhat apart from Prof. Müller's restricted theory. But the question follows, how from these wider thoughts do we become possessed of the faculty of abstraction. Does not the one shade imperceptibly into the other? Prof. Müller answers no, and here I think he is at fault. It is at this point that anthropologists part company with him. If he be right, how do people learn? According to his theory, new thoughts when they arise, start into being under some general concept. I do not deny that they are placed under some general concept, but it seems to me that something entirely independent of the general concept has, for convenience, been placed under it, and this something must be called a thought. No doubt the thought is at first vague and indefinite, and only when it becomes definite does it require a name. But here one can plainly trace the genesis of a thought, and the adaption of a word as a symbol for it. The new concept and its sign do not arise simultaneously. There are two distinct growths, not one only, as Prof. Müller's theory presupposes. The connexion may be